AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1-8. (Cancelled)

9. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising a water soluble polymer into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises a water-soluble polymer.~~

10. (Original) The method of claim 9 wherein the water-soluble polymer further comprises a water-soluble copolymer of at least one nonacidic ethylenically unsaturated polar monomer and at least one copolymerizable ethylenically unsaturated ester.

11. (Original) The method of claim 10 wherein the water-soluble polymer further comprises an acrylate group.

12. (Original) The method of claim 9 wherein the sealant further comprises a metal crosslinking agent.

13. (Original) The method of claim 12 wherein the metal crosslinking agent comprises chromium, iron, aluminum, or zirconium.

14. (Original) The method of claim 12 wherein the metal crosslinking agent is selected from the group consisting of: a halide; a carboxylate; or a complex.

15. (Original) The method of claim 9 wherein the sealant further comprises an organic crosslinking agent.

16. (Original) The method of claim 15 wherein the organic crosslinking agent is a polyalkyleneimine, a polyalkylenepolyamine, or a mixture thereof.

17. (Original) The method of claim 16 wherein the polyalkyleneimine is a polymerized ethyleneimine or a polymerized propyleneimine.

18. (Original) The method of claim 16 wherein the polyalkylenepolyamine is polyethylenepolyamine or polypropylenepolyamine.

19. (Original) The method of claim 15 wherein the organic crosslinking agent comprises a water-soluble polyfunctional compound selected from the group consisting of: aliphatic amines; aralkylamines; and heteroaralkylamines.

20. (Currently Amended) The method of claim [[~~1~~]] 9 wherein the sealant further comprises a crosslinking agent ~~and a water-soluble polymer~~.

21. (Original) The method of claim 20 wherein the water-soluble polymer is selected from the group consisting of: polyacrylamide; 2-acrylamido-2-methylpropane sulfonic acid / acrylamide copolymers; sulfonated styrene / maleic anhydride copolymers; vinylpyrrolidone / 2-acrylamido-2-methylpropane sulfonic acid / acrylamide terpolymers; 2-acrylamido-2-methylpropane sulfonic acid / N-N-dimethyl-acrylamide / acrylamide terpolymers; and mixtures thereof.

22. (Original) The method of claim 20 wherein the crosslinking agent comprises a polyalkyleneimine, a polyalkylenepolyamine, or a mixture thereof.

23. (Original) The method of claim 20 wherein the sealant further comprises a metal crosslinking agent.

24. (Original) The method of claim 23 wherein the metal crosslinking agent comprises chromium, iron, aluminum, or zirconium.

25. (Original) The method of claim 23 wherein the metal crosslinking agent is selected from the group consisting of: a halide; a carboxylate; or a complex.

26. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising a water-soluble polymerizable monomer, a multifunctional monomer, and a polymerization initiator into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises a water-soluble polymerizable monomer, a multifunctional monomer, and a polymerization initiator.~~

27. (Original) The method of claim 26 wherein the water-soluble polymerizable monomer further comprises acrylic acid, methacrylic acid, acrylamide, methacrylamide, 2-methacrylamido-2-methyl propane sulfonic acid, 2-acrylamido-2-methyl propane sulfonic acid,

N-N-dimethylacrylamide, vinyl sulfonic acid, N,N-dimethylaminoethylmethacrylate, 2-triethylammoniumethyl methacrylate chloride, N,N-dimethylaminopropylmethacrylamide, methacrylamide, methacrylamidopropyl trimethylammonium chloride, N-vinyl pyrrolidone, vinylphosphonic acid, methacryloyloxyethyl trimethylammonium sulfate, or a mixture thereof.

28. (Original) The method of claim 26 wherein the multifunctional monomer further comprises tetraethylene glycol diacrylate, glycerol dimethacrylate, glycerol diacrylate, ethoxylated glycerol dimethacrylate, ethoxylated glycerol diacrylate, propoxylated glycerol dimethacrylate, propoxylated glycerol diacrylate, ethoxylated glycerol trimethacrylate, ethoxylated glycerol triacrylate, propoxylated glycerol trimethacrylate, propoxylated glycerol triacrylate, ethoxylated trimethylol propane trimethacrylate, propoxylated trimethylolpropane trimethacrylate, ethoxylated trimethylolpropane triacrylate, propoxylated trimethylolpropane triacrylate, ethoxylated or propoxylated pentaerythritol di-, tri-, or tetra- methacrylate or acrylate, methylene-bis-acrylamide, methylene-bis-methacrylamide, or a mixture thereof.

29. (Original) The method of claim 26 wherein the polymerization initiator comprises a water soluble compound that forms free radicals in an aqueous solution.

30. (Original) The method of claim 29 wherein the polymerization initiator is an azo compound.

31. (Original) The method of claim 29 wherein the polymerization initiator is selected from the group consisting of: alkali metal persulfates; peroxides; and oxidation-reduction systems employing reducing agents.

32. (Original) The method of claim 30 wherein the azo compound is selected from the group consisting of: 4,4'-azobis (4-cyanopentanoic acid), 2,2'-azobis(N,N'-dimethylene isobutyramidine) dihydrochloride, 2,2'-azobis(2-amidinopropane) dihydrochloride, and 2,2'-azobis(2-methyl-N-(2-hydroxyethyl) propionamide).

33. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising a water-soluble hydroxy unsaturated carbonyl and a polymerization initiator into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises a water-soluble hydroxy unsaturated carbonyl and a polymerization initiator.~~

34. (Original) The method of claim 33 wherein the water-soluble hydroxy unsaturated carbonyl comprises hydroxyethylacrylate, hydroxymethylacrylate, hydroxyethylmethacrylate, N-hydroxymethylacrylamide, N-hydroxymethylmethacrylamide, polyethylene glycol acrylate, polypropylene glycol acrylate, polyethylene glycol methacrylate, polypropylene glycol methacrylate, or a mixture thereof.

35. (Original) The method of claim 33 wherein the polymerization initiator further comprises a water-soluble compound that forms free radicals in an aqueous solution.

36. (Original) The method of claim 35 wherein the polymerization initiator is selected from the group consisting of: azo compounds; alkali metal persulfates; peroxides; and oxidation-reduction systems employing reducing agents.

37. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising an aqueous alkali metal silicate solution and a delayed activator into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises an aqueous alkali metal silicate solution and a delayed activator.~~

38. (Original) The method of claim 37 wherein the aqueous alkali metal silicate solution comprises sodium silicate, potassium silicate, lithium silicate, rubidium silicate, or cesium silicate.

39. (Original) The method of claim 37 wherein the delayed activator comprises triethyl citrate, ethyl acetate, ethyl glutamate, sodium acid pyrophosphate, lactose, or urea.

40-46. (Cancelled)

47. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising an epoxy resin and a gas into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 45 wherein the sealant further comprises a gas.~~

48. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising a water-dispersible acrylamide-containing polymer and a water-dispersible crosslinker into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises a water-dispersible acrylamide-containing polymer and a water-dispersible crosslinker.~~

49. (Original) The method of claim 48 wherein the water-dispersible crosslinker further comprises an aldehyde.

50. (Original) The method of claim 49 wherein the water-dispersible crosslinker further comprises a material selected from the group consisting of: phenol; a salicylic acid derivative; phenyl acetate; resorcinol; and hydroquinone.

51. (Original) The method of claim 48 wherein the water-dispersible acrylamide-containing polymer comprises a homopolymer of acrylamide monomer.

52. (Original) The method of claim 48 wherein the water-dispersible acrylamide-containing polymer comprises a copolymer of acrylamide monomer with an ethylenically unsaturated monomer selected from the group consisting of: acrylic acid; methacrylic acid; vinyl sulfonic acid; vinyl benzyl sulfonic acid; vinyl acetate; acrylonitrile; methyl acrylonitrile; vinyl alkyl ether; vinyl chloride; maleic anhydride; vinyl substituted cationic quatenary ammonium compounds; 2-acrylamido-2-methylpropane sulfonic acid; sodium 2-acrylamido-2-methylpropane sulfonate; and vinyl pyrrolidone.

53. (Original) The method of claim 50 wherein the salicylic acid derivative is selected from the group consisting of: salicylamide and acetylsalicylic acid.

54. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising an amine-based polymer, a polysaccharide-based polymer, and an oxidizing agent into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises an amine-based polymer, a polysaccharide-based polymer, and an oxidizing agent.~~

55. (Original) The method of claim 54 wherein the amine-based polymer comprises at least one member selected from the group consisting of: chitosan; chitosan salts; oxidized chitosan; poly(vinyl alcohol – vinyl amine); polylysine; polyethyleneimine; and mixtures thereof.

56. (Original) The method of claim 54 wherein the polysaccharide-based polymer is selected from the group consisting of: starch; cellulose; agarose; partially acetylated cellulose; hydroxyethylcellulose; gum; and mixtures thereof.

57. (Original) The method of claim 56 wherein the gum comprises guar, locust bean gum, gum arabic, tragacanth, gutta percha, xanthan salts, alginate salts, carrageenan, scleroglucan, or a mixture thereof.

58. (Original) The method of claim 54 wherein the oxidizing agent is selected from the group consisting of: alkali, alkaline earth and transition metal salts of materials selected from the group consisting of: periodate; hypochlorite; perbromate; chlorite; chlorate; hydrogen peroxide; soluble peroxide salts; persulfate salts; percarboxylic acids; oxyhalo acids; and mixtures thereof.

59. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising an oxidized chitosan-based compound and a water-soluble compound having carbonyl groups into a region of a subterranean formation surrounding

a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises an oxidized chitosan-based compound and a water-soluble compound having carbonyl groups.~~

60. (Original) The method of claim 59 wherein the water-soluble compound having carbonyl groups comprises an acrylamide-based polymer.

61. (Original) The method of claim 60 wherein the acrylamide-based polymer is selected from the group consisting of: partially hydrolyzed polyacrylamide; a copolymer of acrylamide and t-butyl acrylate; a copolymer of acrylamide and 2-acrylamido-2-methyl propane sulfonic acid; and mixtures thereof.

62. (Original) The method of claim 60 wherein the water-soluble compound having carbonyl groups comprises oxidized starch.

63. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising water, lignosulfonate and a dichromate into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises water, lignosulfonate and a dichromate.~~

64. (Original) The method of claim 63 wherein the dichromate is sodium dichromate.

65. (Original) The method of claim 63 further comprising calcium chloride.

66. (Currently Amended) A method for sealing junctions between subterranean well bores comprising the steps of:

placing a sealant comprising a hardenable organic consolidating fluid, the hardenable organic consolidating fluid further comprising a hardenable organic resin and a resin-to-sand coupling agent into a region of a subterranean formation surrounding a junction between a first well bore and a second well bore that is in fluid communication with the first well bore; and

allowing the sealant to penetrate into the formation to a desired depth and solidify therein. ~~The method of claim 1 wherein the sealant comprises a hardenable organic consolidating fluid, the hardenable organic consolidating fluid further comprising a hardenable organic resin and a resin-to-sand coupling agent.~~

67. (Original) The method of claim 66 wherein the hardenable organic resin is selected from the group consisting of: epoxy resins; phenol-aldehyde resins; furfuryl alcohol resins; and urea-aldehyde resins.

68. (Original) The method of claim 67 wherein the resin-to-sand coupling agent is an aminosilane compound.

69. (Original) The method of claim 68 wherein the aminosilane compound is selected from the group consisting of: gamma-aminopropyltriethoxysilane; N-beta-(aminoethyl)-gamma-aminopropyltrimethoxysilane; N-beta-(aminoethyl)-N-beta-(aminoethyl)-gamma-aminopropyltrimethoxysilane; N-beta-(aminopropyl)-N-beta-(aminobutyl)-gamma-aminopropyltriethoxysilane; di-N-(beta-aminoethyl)-gamma-aminopropyltrimethoxysilane; N-beta-(aminoethyl)-gamma-aminopropyl-trimethoxysilane; N-beta-(aminoethyl)-N-beta-(aminoethyl)-gamma-aminopropyltrimethoxysilane; and N-beta-(aminopropyl)-gamma-aminopropyltriethoxysilane.

70. (Original) The method of claim 66 further comprising the step of contacting the hardenable organic consolidating fluid with a hardening agent.

71. (Original) The method of claim 70 wherein the hardening agent is selected from the group consisting of: dimethylaminopropylamine; benzyldimethylamine; diethylaminopropylamine; diethylenetriamine; metaxylene diamine; metaphenylene diamine; diaminodiphenylmethane; piperidine; tridimethylaminomethylphenol; oxalic anhydride; phthalic anhydride; pyromellitic dianhydride; dodecynyl succinic anhydride; hexahydrophthalic anhydride; methylbicyclo-(2,2,1)-5-heptene-2-3-dicarboxylic anhydride; and polymercaptan hardening agents.

72. (Original) The method of claim 70 wherein the hardening agent is selected from the group consisting of: hexachloroacetone; 1,1,3-trichloro-trifluoroacetone; benzotrichloride; benzyl chloride; and benzal chloride.

73. (Original) The method of claim 70 wherein the hardening agent is selected from the group consisting of: phthaloyl chloride; fumaryl chloride; benzoyl chloride; trichloro-acetic acid; benzotrichloride; acetic acid; formic acid; and hydrochloric acid.

74-76. (Cancelled)

77. (New) The method of claim 47 wherein the epoxy resin is selected from the group consisting of epichlorohydrin and 4,4'- isopropylidenediphenol.

78. (New) The method of claim 47 wherein the gas is selected from the group consisting of air and nitrogen.